Public Report
ESA-069-3

Company	Owens Corning	**ESA Dates**	April 23-25, 2008
Plant	Kearny, NJ	**ESA Type**	Compressed Air
Product	Asphalt Roofing materials	**ESA Specialist**	Greg Wheeler

Brief Narrative Summary Report for the Energy Savings Assessment:

Introduction:
The Owens Corning plant in Kearny, NJ, manufactures asphalt laminated shingles of various weights and grades. Raw materials are fiberglass webbing, asphalt, granules, sand, and sealant. The web is unwound and coated. Granules and sand are applied and the web is pressed. Then the web is cut into strips and patterns, sealant added, and the strips are pressed into shingles. Finally the shingles are stacked, shrink wrapped, palletized and stored until shipping.

The shingle production process can be divided into four major parts: the loading and splicing of fiberglass mat, asphalt coating and granule application, web cooling, shingle cutting and packaging.

Objective of ESA:
The objective of the ESA is to model your compressed air system using the AIRMaster+ software tool and to use the tool to identify savings from several measures that would improve system efficiency. It is not the objective of the ESA to look at all potential plant improvement opportunities.

Focus of Assessment:
The focus of the ESA is for plant personnel to understand how the appropriate DOE tool can be effectively applied in the plant. The focus of this ESA is the main compressed air system.

The compressed air system:

Compressor Summary						
#	**Manufacturer**	**Model**	**acfm**	**hp**	**Type**	**kW**
	System Totals		751	160		140.3

The compressed air dryers are twin-tower desiccant type with heatless regeneration.

The air distribution system has 5 receivers and approximately 1,200 feet of header piping with diameters ranging from 2 to 4”. Pressure drop from compressors to far end-uses is approximately 10 psi.

Approach for ESA:
1. Identify and understand the compressed air system(s) and determine priorities for opportunities to pursue.
2. Identify critical airflows, pressures, end uses, temperatures and other information that will be required for the analysis.

3. Gather available data and trend logs and develop a list of data that needs to be obtained from other sources or that needs to be measured or logged.
4. Reduce and enter this data into the AIRMaster tool and check for internal consistency, such as with metered energy use. Data will be verified and adjusted, if necessary. Team members will enter data into the AIRMaster tool and check results for feasibility.
5. Acquire cost estimates from vendors if possible. Estimate range of improvement costs from previous plant and Qualified Specialist experience.
6. Demonstrate AIRMaster to interested participants.
7. Complete:
   - Plant Intake Questions
   - Summary Report
   - Software Tool Output
   - Evaluation

Note what you would expect would be Near Term, Medium Term, Long Term opportunities. See definitions below:

- ❑ Near term opportunities would include actions that could be taken as improvements in operating practices, maintenance of equipment or relatively low cost actions or equipment purchases.
- ❑ Medium term opportunities would require purchase of additional equipment and/or changes in the system such as addition of recuperative air preheaters and use of energy to substitute current practices of steam use etc. It would be necessary to carryout further engineering and return on investment analysis.
- ❑ Long term opportunities would require testing of new technology and confirmation of performance of these technologies under the plant operating conditions with economic justification to meet the corporate investment criteria.

Results.

The following results and recommendations represent the best information that we have at the time. The results and estimated savings are reasonable, but the plant team recommends getting more long-term operating data and equipment quotes before modifying the compressed air system based on these results.

Compressor currents were collected using Hobo data loggers on the four operating compressors and system pressure. Recording interval was set for 6 seconds. One week of data was collected. Compressor power was calculated for each data point using measured amps, voltage and nameplate power factor.

Calculated power for all operating compressors was imported into the Log Tool. Four daytypes were identified: Weekday, Saturday, Monday, and Sunday/Down days. Hourly average profiles were exported to a spreadsheet and were imported into AirMaster+ for analysis. Results from 4 Energy Efficiency Measures (EEM) are included.

Identified Opportunity	Savings/year		
	Total $	Imp Cost	Est Payback (years)
Repair Compressors	22,400	4,000	0.2
Reduce Air Leaks	30,300	15,000	0.5
Turn off Bag Houses	6,300	2,000	0.3
Reduce System Air Pressure	12,800	1,000	0.1
Repair Sequencer	1,800	1,000	0.6
Total	73,600	23,000	0.3

1. **Repair compressors.** (savings 3.5% of plant electricity use, 18.0% of compressor use, Near Term)

Situation. Compressors operate most efficiently at full load. Two compressors did not appear to be operating properly. Compressor #1 did not operate at full load nor unload properly, so generic performance points were used. Logged data indicated that Compressor #1 operated with throttled inlet at approximately 20% capacity. Compressor #2 appeared to throttle properly to unloaded condition but did not operate above 50% capacity.

Solution: Repair compressors to operate properly at full load and unloaded conditions. This will allow all operating compressors except one to operate efficiently at full load. The swing compressor will operate at partload.

Savings: AIRMaster calculates savings from repairing and operating compressors more efficiently, allowing one compressor to be turned off, to be approximately $22,400/yr. We estimated the cost to be approximately $4,000 with a 0.2-year payback.

2. **Reduce Air Leaks** (savings 5.1% of plant electricity use, 26.2% of compressor use, Near Term)

Situation: Air leaks can be heard and felt at several locations in the plant. The plant was down on the Sunday before the ESA visit. Data loggers determined air use on Sunday to be approximately 500 acfm. This includes 7 bag houses that use pulses of compressed air to clean the bags, timed purge cycles on the air dryers, and cleaning optical sensors.

Solution: Establish an ongoing program to inspect periodically, tag, and repair air leaks to keep air leakage to a minimum. Leaks should be tagged and reported as found by plant personnel in the course of their work and all piping should be inspected at least semiannually. An air leak generally costs around $1,425/year at $0.09/kWh by the time it can be heard. Fixing leaks is generally low cost in both time and materials, with paybacks typically less than one-year. We estimated that air leaks could be reduced by approximately 150 acfm. Maintenance staff has already adjusted bag house pulse and air dryer purge settings to reduce air use. Reducing leaks would also include optimizing air dryer and dust collector purge cycles and replacing open blowing with fans and nozzles.

Savings: The plant air system operates 8,760 hours/year. We recommend purchasing an ultrasonic leak detector. AirMaster calculates savings to be $30,300/yr with a 0.5-year payback.

3. **Turn Off Bag Houses.** (savings 1.1% of plant electricity use 5.7% of compressor use, Near Term)

Situation: Seven bag houses currently use pulses of compressed air to clean the bags. The pulses are currently set for durations between 0.1 and 0.5 seconds and with pressures reduced to between 45 and 70 psig. We calculate this use to require 140 scfm from bag-house manufacturer specs. The bag houses currently operate 8760 hours/year.

Solution: Turn off power to the bag houses during Sundays and down days. This would also disable the solenoid valves that supply pulses of air.

Savings: AIRMaster calculates savings to be approximately $6,300/yr. We estimate the cost to modify wiring or add switches, to facilitate turning off all bag houses on down days to be $2,000 for a 0.3-year payback.

4. Reduce System Pressure (savings 1.6% of plant electricity use, 8.2% of compressor use, Near Term)

Situation: The compressors operate between 95 and 105 psig with a target of 100 psig. After filters and dryers, pressure is supplied to the plant at approximately 90 psig. The plant has adequate air receivers and storage and good distribution piping with no significant pressure drops. The equipment can operate at 80 psig and has operated satisfactorily as low as 60 psig.

Solution: Consider reducing the discharge pressure at the compressors by 20 psi. Begin by reducing pressure in small steps, such as 1 psi, and continue if there are no problems. If a problem arises, consider the cost of resolving the problem versus the savings from reducing pressure. For example, adding another secondary receiver near an end use to meet an intermittent load, closing a piping loop, or adding a dedicated or booster compressor to satisfy a critical or higher-pressure load. A sequencer or other system control system would also control pressure in a tighter range.

Savings: Savings are approximately ¾% for each psi that pressure can be reduced, including reduced airflow and power savings. AirMaster calculates savings from reducing system pressure 20 psi to be approximately $12,800/yr. Plant currently has a 350-gallon receiver from another plant that could be installed in the packaging area at a plant-estimated cost of $1,000 with a 0.1-year payback. Alternate methods include a dedicated compressor operating at higher pressure or a pressure booster for the packaging area.

5. Repair Sequencer. (savings 0.3% of plant electricity use, 1.5% of compressor use, Near Term)

Situation. Compressors operate most efficiently at full load. A lead-lag sequencer in the compressor room was not functional. It most likely has 3 pressure controls with offset operating pressure ranges. The controller would shift the pressure range controllers to the selected compressor sequence order.

Solution: After repair, all operating compressors except one should operate efficiently at full load. The swing compressor will operate at part-load. Efficient operation will require compressors to operate in the load-unload mode, otherwise offset pressure ranges allow multiple compressors to operate inefficiently at part load. The lead-lag controller will allow setting the swing compressor to the smallest compressor that will meet the load or to the most efficient compressor at part load. The optimum swing compressor might change hourly and daily with plant production. A sequencer facilitates optimization.

Savings: AIRMaster calculates savings from operating compressors more efficiently with a refurbished lead lag controller to be approximately $1,800/yr. We estimated the cost to be approximately $1,000 with a 0.6-year payback.

Note: An alternative control strategy is to purchase and install a new sequencer that can be programmed to automatically operate the most efficient combination of compressors to meet expected loads and turn the rest off until needed. An additional benefit might be reducing the operating pressure range from 10 psi to less than 5 psi with a single pressure control point. We estimate the cost for a sequencer to be approximately $20,000. This alternative is not recommended at this time due to the long payback. Consider this alternative if operator manual control or the lead-log controller do not achieve potential savings.

Operation and Maintenance Opportunities
1. Reset dryer purge and bag house pulse cleaning to optimum 2. Use fan/blowers for cleanoff 3. Add solenoid to pulse cleaning for 3 optical sensors. 4. Replace 3 timed solenoid drains with lossless drains

Other Measures Considered
1. Add dedicated compressor(s) to the dry fire system and shut down the main system on down days. Not recommended because system has 6 risers and needs air for hot oil control system. 2. Consider replacing 3 pneumatic with electric pumps. Not recommended because diaphragms last much longer in abrasive conditions and the quantity is small and use is intermittent.

Management Support and Comments:

Owens Corning has a corporate Sustainability Leader, a goal to reduce energy use by 25% by 2012, and a longer 3-year payback for energy investments.

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